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Standard Specification for Bunch-Stranded Copper Conductors for Electrical Conductors¹

This standard is issued under the fixed designation B174; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ϵ) indicates an editorial change since the last revision or reapproval.

This standard has been approved for use by agencies of the Department of Defense.

~~^{ε1}Note—Table 1 was editorially corrected in March 2007.~~

1. Scope

1.1 This specification covers bare bunch-stranded conductors made from round copper wires, either uncoated or coated with tin, lead, or lead-alloy for use as electrical conductors (Explanatory Note 1 and Explanatory Note 2).

1.2 Coated wires shall include only those wires with finished diameters and densities substantially equal to the respective diameters and densities of uncoated wires.

1.3 The values stated in ~~inch-pound~~ either SI units or ~~SI~~ inch-pound units are to be regarded separately as standard. ~~Each~~ The values stated in each system may not be exact equivalents; therefore, each system shall be used independently of the other. Combining values ~~form~~ from the two systems may result in non-conformance with the ~~specification~~ ~~for~~ standard.

1.3.1 For conductor sizes designated by AWG or kcmil, the requirements in SI units have been numerically converted from corresponding values, stated or derived, in inch-pound units. For conductor sizes designated by SI units only, the requirements are stated or derived in SI units.

2. Referenced Documents

2.1 The following documents of the issue in effect at the time of reference form a part of this specification to the extent referenced herein:

2.2 *ASTM Standards*:²

B3 Specification for Soft or Annealed Copper Wire

B33 Specification for Tin-Coated Soft or Annealed Copper Wire for Electrical Purposes

B172 Specification for Rope-Lay-Stranded Copper Conductors Having Bunch-Stranded Members, for Electrical Conductors

B189 Specification for Lead-Coated and Lead-Alloy-Coated Soft Copper Wire for Electrical Purposes

B193 Test Method for Resistivity of Electrical Conductor Materials

B263 Test Method for Determination of Cross-Sectional Area of Stranded Conductors

B354 Terminology Relating to Uninsulated Metallic Electrical Conductors

2.3 *American National Standard*:

ANSI C42.35 Definitions of Electrical Terms³

3. Classification

3.1 For the purpose of this specification bunch-stranded conductors are classified as shown in ~~Table 1~~ Tables 1 and 2.

4. Ordering Information

4.1 Orders for material under this specification shall include the following information:

4.1.1 Quantity of each size and class,

4.1.2 Conductor size: circular-mil area or AWG (see 7.1),

¹ This specification is under the jurisdiction of ASTM Committee B01 on Electrical Conductors and is the direct responsibility of Subcommittee B01.04 on Conductors of Copper and Copper Alloys.

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² For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

³ Available from American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036, <http://www.ansi.org>.

TABLE 1 A Classification and Construction Requirements of Bunch-Stranded Conductors^A—Class I Bunch Stranded Conductors

Area of Cross Section		Size, AWG	Classification, Size, and Minimum Number of Wires						Uncoated Copper		Coated Copper	
Area of Cross Section			Classification, Size, and Minimum Number of Wires		Classification, Size, and Minimum Number of Wires		Classification, Size, and Minimum Number of Wires		Classification, Size, and Minimum Number of Wires		Classification, Size, and Minimum Number of Wires	
Size, AWG	Class I		Class J	Class K	Class L	Class M	Class O	Class P	Class Q			
Size, AWG	Class I	Nominal dc resistance @20C	Maximum dc resistance @20C	Nominal dc resistance @20C	Maximum dc resistance @20C	Nominal dc resistance @20C	Maximum dc resistance @20C	Class Q				
Wire Diameter 0.0201 in. (0.511 mm) Maxin. (0.511 mm) No.20C	Wire Diameter 0.0201 in. (0.511 mm) Maxin. (0.511 mm) No.20C											
emil	mm	24 AWG	ohm/kft	ohm/kft	ohm/km	ohm/km	ohm/kft	ohm/kft	ohm/km	ohm/km	ohm/km	ohm/km
cmil	mm	24 AWG	ohm/kft	ohm/kft	ohm/km	ohm/km	ohm/kft	ohm/kft	ohm/km	ohm/km	ohm/km	ohm/km
20820	10.5	7	52	0.508	1.67	1.70	0.528	0.539	1.73	1.77		
16510	8.37	8	41	0.641	0.654	2.10	2.14	0.666	0.679	2.19	2.23	
13090	6.63	9	33	0.808	0.824	2.65	2.70	0.840	0.857	2.76	2.81	
10380	5.26	10	26	1.02	1.04	3.34	3.41	1.06	1.08	3.48	3.55	

TABLE 1 B Classification and Construction Requirements of Bunch-Stranded Conductors—Class J Bunch Stranded Conductors^A

Area of Cross Section		Classification, Size, and Minimum Number of Wires		Uncoated Copper		Coated Copper	
Area of Cross Section		Classification, Size, and Minimum Number of Wires		Uncoated Copper		Coated Copper	
Size, AWG	Class J	Nominal dc resistance @20C	Maximum dc resistance @20C	Nominal dc resistance @20C	Maximum dc resistance @20C	Nominal dc resistance @20C	Maximum dc resistance @20C
Wire Diameter 0.0126 in. (0.320 mm) No. 28 AWG	Wire Diameter 0.0080 in. (0.203 mm) No. 32 AWG						
emil	mm	28 AWG	ohm/kft	ohm/kft	ohm/km	ohm/km	ohm/km
cmil	mm	28 AWG	ohm/kft	ohm/kft	ohm/km	ohm/km	ohm/km
20-820	10.5	7	52	...	...	...	...
10380	5.26	10	65	1.02	1.04	3.34	3.41
16-510	8.37	8	41	...	...	...	...
6530	3.31	12	41	1.62	1.65	5.31	5.42
13-090	6.63	9	33	...	...	...	...
4110	2.08	14	26	2.57	2.62	8.44	8.61
10-380	5.26	10	26	65	104	165	...
2580	1.31	16	16	4.10	4.18	13.5	13.7
6-530	3.31	12	...	41	65	104	...
1620	0.821	18	10	6.53	6.66	21.4	21.9
4-110	2.08	14	...	26	41	65	104
1020	0.517	20	7	10.4	10.6	34.0	34.7

TABLE 1 C Classification and Construction Requirements of Bunch-Stranded Conductors—Class K Bunch Stranded Conductors^A

Area of Cross Section		Classification, Size, and Minimum Number of Wires		Uncoated Copper		Coated Copper	
Area of Cross Section		Classification, Size, and Minimum Number of Wires		Uncoated Copper		Coated Copper	
Size, AWG	Class K	Nominal dc resistance @20C	Maximum dc resistance @20C	Nominal dc resistance @20C	Maximum dc resistance @20C	Nominal dc resistance @20C	Maximum dc resistance @20C
Wire Diameter 0.0100 in. (0.254 mm)	Wire Diameter 0.0100 in. (0.254 mm)						
emil	mm	30 AWG	ohm/kft	ohm/kft	ohm/km	ohm/km	ohm/km
cmil	mm	30 AWG	ohm/kft	ohm/kft	ohm/km	ohm/km	ohm/km
10380	5.26	10	104	1.65	1.67	5.35	5.41
6530	3.31	12	41	1.62	1.65	5.31	5.42
4110	2.08	14	26	2.57	2.62	8.44	8.61
2580	1.31	16	16	4.10	4.18	13.5	13.7
1620	0.821	18	10	6.53	6.66	21.4	21.9
1020	0.517	20	7	10.4	10.6	34.0	34.7

TABLE 2 Classification and Construction Requirements of Bunch-Stranded Conductors—Class L, M, O, P and Q Bunch Stranded Conductors^A

Area of Cross Section		Classification, Size, and Minimum Number of Wires					Uncoated Copper		Coated Copper		Uncoated Copper		Coated Copper	
		Class L	Class M	Class O	Class P	Class Q	Nominal dc resistance @20C	Maximum dc resistance @20C	Nominal dc resistance @20C	Maximum dc resistance @20C	Nominal dc resistance @20C	Maximum dc resistance @20C	Nominal dc resistance @20C	Maximum dc resistance @20C
Size, AWG		Nominal Wire Diameter 0.0080 In. (0.511 mm)	Nominal Wire Diameter 0.0063 In. (0.320 mm)	Nominal Wire Diameter 0.0050 In. (0.254 mm)	Nominal Wire Diameter 0.0040 In. (0.320 mm)	Nominal Wire Diameter 0.0031 In. (0.254 mm)	ohm/kft	ohm/kft	ohm/km	ohm/km	ohm/kft	ohm/kft	ohm/km	ohm/km
10380	5.26	10	165	...	...	...	1.02	1.04	3.34	3.41	1.09	1.12	3.58	3.65
6530	3.31	12	104	...	...	...	1.62	1.65	5.31	5.42	1.74	1.77	5.71	5.82
4110	2.08	14	65	104	...	...	2.57	2.62	8.43	8.60	2.76	2.82	9.06	9.24
2580	1.31	16	41	65	104	165	4.10	4.18	13.5	13.7	4.40	4.49	14.4	14.7
1620	0.821	18	26	41	65	104	6.53	6.66	21.4	21.9	7.00	7.15	23.0	23.4
1020	0.517	20	16	26	41	65	10.4	10.6	34.1	34.8	11.1	11.4	36.4	37.1
640	0.324	22	...	19	...	...	16.5	16.9	54.1	55.2	17.7	18.1	58.1	59.2
404	0.205	24	7	...	19	...	26.2	26.7	86.0	87.7	28.1	28.7	92.2	94.0
253	0.128	26	...	7	...	...	41.8	42.6	137	140	44.9	45.8	147	150

^A The constructions shown in this table are typical of those used in the industry. It is intended that this table preclude other constructions which may be desirable for specific applications. The constructions shown provide for a finished stranded conductor approximately of the area indicated. When specified by the purchaser, the number or sizes of wire may be increased to provide additional area to compensate for draw-down during subsequent processing.

- 4.1.3 Class (Section 3 and Table 2-Table 3),
- 4.1.4 Whether coated or uncoated; if coated, designate type of coating (see 11.1),
- 4.1.5 Maximum length of lay (see 6.3),
- 4.1.6 Whether separator is required (see 7.2),
- 4.1.7 Package size (see section 15.1),
- 4.1.8 Special package marking, if required (Section 14), and
- 4.1.9 Place of inspection (Section 13).

5. Joints

5.1 Necessary joints in wires shall be made in accordance with accepted commercial practice.

5.2 Joints shall be so constructed and so disposed throughout the conductor that the diameter or configuration of the completed conductor is not substantially affected, and so that the flexibility of the completed conductor is not adversely affected.

6. Lay

6.1 Conductors of the same size and description furnished on one order shall have the same lay.

6.2 The direction of lay shall be at the option of the manufacturer unless otherwise specified.

TABLE-2 3 Maximum Length of Lay for Bunch-Stranded Conductors

Area of Cross Section		Size, AWG	Maximum Length of Lay					
			Nominal Diameter		Column A		Column B	
cmil	mm		in.	mm	in.	mm	in.	mm
20 820	10.5	7	0.167	4.24	3.00	76.20	3.00	76.20
16 510	8.37	8	0.149	3.78	2.75	69.85	2.75	69.85
13 090	6.63	9	0.133	3.38	2.50	63.50	2.50	63.50
10 380	5.26	10	0.118	3.00	2.50	63.50	2.50	63.50
6 530	3.31	12	0.093	2.36	2.00	50.80	2.00	50.80
4 110	2.08	14	0.074	1.88	2.00	50.80	1.75	44.45
2 580	1.31	16	0.059	1.50	2.00	50.80	1.50	38.10
1 620	0.821	18	0.047	1.19	2.00	50.80	1.25	31.75
1 020	0.517	20	0.037	0.94	2.00	50.80	1.00	25.40
640	0.324	22	0.030	0.76	1.30	33.02	0.80	20.32
404	0.205	24	0.024	0.61	1.20	30.48	0.70	17.78
253	0.128	26	0.019	0.48	1.00	25.40	0.60	15.24
159	0.0806	28	0.015	0.38	1.00	25.40	0.50	12.70